A modified two-factor multivariate analysis of variance: asymptotics and small sample approximations

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Abstract   In this paper, we present results for testing main, simple and interaction effects in heteroscedastic two factor MANOVA models. In particular, we suggest modifications to the MANOVA sum of squares and cross product matrices to account for heteroscedasticity. Based on these modified matrices, we define some multivariate test statistics and derive their asymptotic distributions under non-normality for the null as well as non-null cases. Derivation of these results relies on the perturbation method and limit theorems for independently distributed random matrices. Based on the asymptotic distributions, we devise small sample approximations for the quantiles of the null distributions. The numerical accuracy of the large sample as well as small sample approximations are favorable. A real data set from a Smoking Cessation Trial is analyzed to illustrate the application of the methods.

Keywords   MANOVA · Perturbation method · Heteroscedasticity · Non-normality · Local alternatives · Multivariate tests